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ABSTRACT

Presented are highlights of U.S. Federal research and development (R&D) funding during fiscal years 1978-80. Data are presented in terms of budget authority for 16 selected Federal budget functions. Data show that the 4 leading functions are national defense, space research and technology, health, and energy. No significant change is seen during the 1978-80 period in the share of the R&D total represented by each function. R&D programs and basic research programs distributed by function are also presented. Five charts and two tables are used to present the data included. (HM)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

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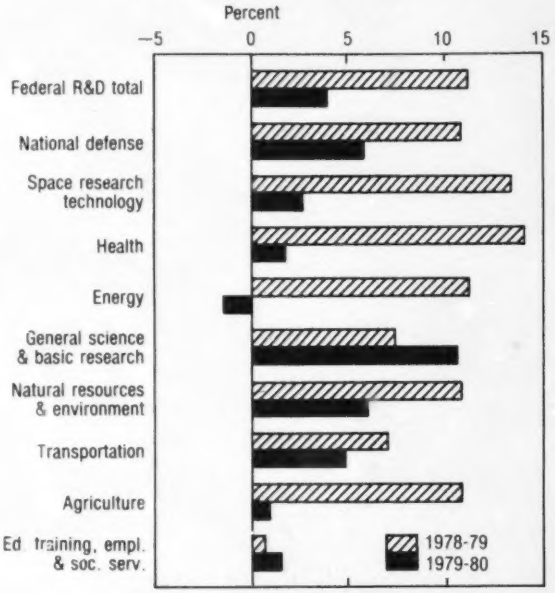
Total Federal R&D Growth Slight In 1980 But Varies By Budget Function

The following data are taken from a special report *Federal R&D Funding by Budget Function: Fiscal Years 1978-80*, relating to the current budget period, and using a function structure that differs from earlier NSF function analyses. Data are provided in terms of budget authority rather than obligations (used in other reports). Budget authority represents authority provided by law, usually in the form of appropriations, to enter into obligations which represent orders placed or contracts awarded or services rendered during a given period. For this report, budget authority data are considered more relevant than obligational data since congressional actions on agency budgets are in terms of budget authority. This new analysis is based on data provided to the Office of Management and Budget by the agencies as background for *Special Analysis L: Research and Development* in the 1980 budget. Further, detailed program information is based on budget justification documents of the leading R&D support agencies and information provided directly to NSF by some of the smaller agencies. Function categories and definitions are the same as those used in the 1980 Federal budget except that the function of **general science, space, and technology** has been divided into two functions: **space research and technology** and **general science and basic research.**

Highlights

- Budget authority as requested for Federal R&D programs in 1980 is $30.6 billion, representing a 4-percent increase over the $29.5 billion estimated for 1979 (including more than $700 million in pending supplemental requests). This increase is less than anticipated inflation and compares with real R&D growth of 3 percent from 1978 to 1979.[1]
- The four leading functions— those with R&D budget authority of more than $3 billion in 1980—all show growth that is less than the projected rate of inflation (chart 1). National defense has the largest gain, 6 percent, with health and space research and technology increasing 2 percent and 3 percent, respectively. Energy reflects an absolute decline. Since these four functions represent more than 8 out of 10 R&D dollars, their levels of growth largely determine the overall Federal R&D funding pattern.
- No significant change is seen during the 1978-80 period in the share of the R&D total represented by each function. For all three years approximately 50 percent of the entire Federal R&D effort is accounted for by defense programs; 13 percent by space research and technology programs; 12 percent by energy pro-

Chart 1. Relative changes in R&D budget authority for selected Federal budget functions:[a] FY 1978-79 and FY 1979-80



[a]Shown in descending order of 1980 R&D budget authority

SOURCE: National Science Foundation

[1] Projected rates of inflation of 8 percent for 1979 and 7 percent for 1980 used in this report were those shown in Office of Management and Budget. *The Budget of the United States Government, Fiscal Year 1980* (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office), p. 35.

Prepared in the Government Studies Group, Division of Science Resources Studies

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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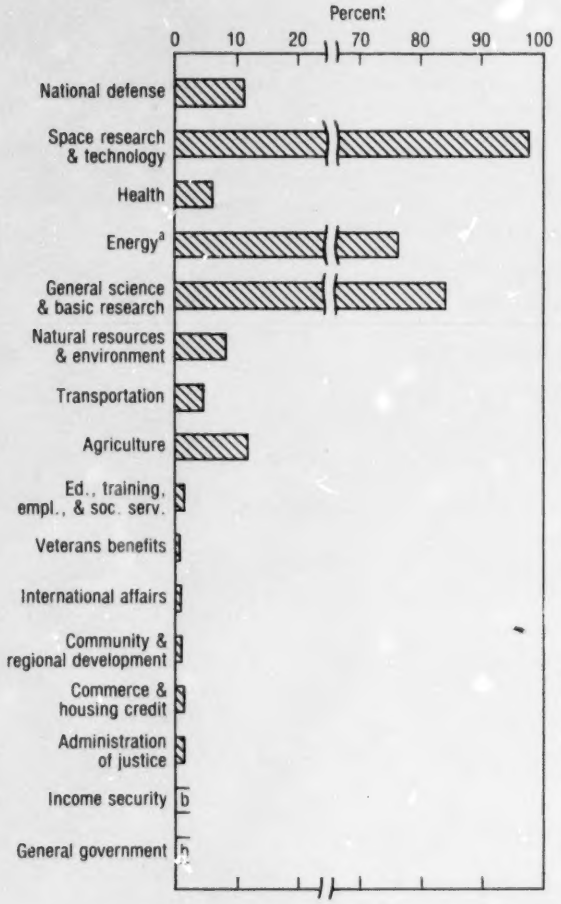
grams; and 11 percent by health programs (although in 1980 the health share is slightly more than that of energy). The remaining 15 percent reflects the R&D programs of the other 12 functions (table 1).

- R&D budget authority represents 5.5 percent of the total 1980 Federal budget (excluding interest), compared with 5.8 percent in 1978 and 1979. Within individual functions, however, the R&D shares vary widely—between 1 percent and 97 percent (chart 2).
- In virtually all functional areas some funds are provided for basic research aimed at gaining general knowledge in the areas germane to the various agency missions but without specific applications in mind. In 1980

Chart 2. R&D programs as a percent of total federal budget authority by function: FY 1980

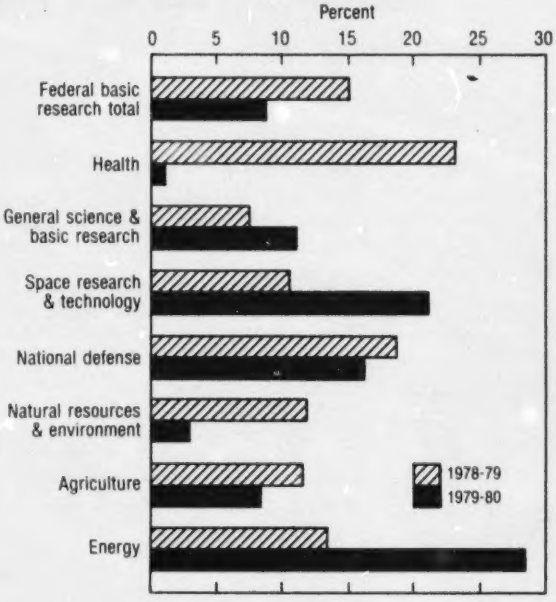


[a]Not included in total energy budget authority is $15 billion in anticipated borrowing authority for the Tennessee Valley Authority power program.

[b]Less than 0.5 percent.

SOURCE: National Science Foundation

Chart 3. Relative increases in budget authority for basic research by selected Federal budget functions:[a] FY 1978-79 and FY 1979-80



[a]Shown in descending order of 1980 budget authority for basic research.

SOURCE: National Science Foundation

budget authority for such research across all functions totals $4.6 billion, an increase of 9 percent over 1979—a little more than anticipated inflation. This compares with a 15-percent increase in 1979, or 6 percent in constant dollars. Three functions, however—energy, space research and technology, and general science and basic research—show greater relative growth for their basic research components in 1980 than in 1979 (chart 3).

- The rates of R&D growth shown for 1979 and 1980 could significantly change as a result of congressional actions on the supplemental 1979 requests and on the entire proposed 1980 budget. For example, the growth in R&D budget authority from 1978 to 1979 as originally proposed in the President's 1979 budget was 7 percent compared with current estimated growth of 11 percent between those years (in current dollars) that results from subsequent congressional actions and pending supplemental requests. Congressional increases over the 1979 proposed budget were notable for health, energy, natural resources and environment, and agriculture R&D programs. The pending 1979 supplemental requests are primarily in the national defense and space research and technology areas.

Table 1. Budget authority for research and development by function[1]

(Dollars in millions)

Function	1978 Actual	1979 Estimate	1980 Estimate
Total	$26,480	$29,451	$30,629
National defense	12,899	[2]14,284	15,115
Space research and technology	3,481	[3]3,944	4,051
Health	2,968	3,387	3,444
Energy	3,134	3,485	3,429
General science and basic research	1,050	1,128	1,248
Natural resources and environment	898	994	1,054
Transportation	767	822	862
Agriculture	501	555	559
Education, training, employment, and social services	344	345	350
Veterans benefits	111	123	123
International affairs	54	75	100
Community and regional development	91	113	94
Commerce and housing credit	76	90	87
Administration of justice	44	46	49
Income security	43	41	44
General government	18	18	19

[1] Listed in descending order of 1980 R&D budget authority. One budget function—general science, space, and technology—has been divided into two functions in this analysis: space research and technology, and general science and basic research.

[2] Includes a $521 million supplemental request of DOD.

[3] Includes a $185 million supplemental request of NASA for the space shuttle.

Source: National Science Foundation.

R&D Programs Distributed by Function

• **National defense** R&D budget authority is scheduled to total $15.1 billion in 1980, a rise of 6 percent over 1979, assuming congressional approval of pending 1979 supplemental requests, or 10 percent should such approval not be forthcoming. Two agencies—the Department of Defense (DOD) and the Department of Energy (DOE)—sponsor all the R&D activities within this functional area. R&D programs represent 11 percent of the total budget authority for national defense.

DOD R&D programs make up 92 percent of the national defense R&D total in 1980, primarily in the areas of technology base and strategic and tactical programs.

DOD *technology base* programs are scheduled to increase 14 percent over the 1979 level, to $2.3 billion. Technology base efforts form the basis for new weapons systems and improvements in existing ones.

DOD *strategic programs* are expected to grow in 1980 by only 1 percent, to $2.4 billion. The budget provides for continued development of the M-X intercontinental ballistic missile, the air-launched cruise missile (ALCM), the advanced ballistic re-entry system, B-52G/H avionics modernization, the Air Force satellite communications system, the fleet ballistic missile system, the Trident submarine, and the Army BMD advanced technology and systems technology programs.

DOD *tactical programs* are scheduled to decrease 1 percent, to $5.3 billion in 1980. Continuing in development are the advanced attack helicopter (AAH), the Patriot (SAM-D) air defense missile system, the Pershing II, the LAMPS MK 111 helicopter, the Navy air combat fighter, the Tomahawk sea-launched cruise missile, and the NAVSTAR global positioning system.

DOE *atomic energy R&D activities,* which are scheduled to increase by 5 percent to about $1.2 billion in 1980, account for the non-DOD portion of R&D budget authority for national defense. Slightly more than one-half this amount is for the DOE weapons R&D and testing program, which is recommended for a 6-percent increase. A proposed decrease in funding for DOE naval reactor development, the next largest program, is more than offset by increases in support for DOE inertial confinement fusion and defense waste management.

• **Space research and technology** R&D activity is conducted entirely by the National Aeronautics and Space Administration (NASA). Total R&D budget authority requested for this function in 1980, is $4.1 billion, an increase of 3 percent over 1979. The ratio of R&D budget authority to total budget authority for this function is high—approximately 97 percent in 1980.

Space transportation systems (STS) is scheduled for a decrease of 4 percent to $2.3 billion, as the space shuttle reaches a later stage of development, moving toward its first orbital flight in 1979 and initial operation in 1981.

An increase of 14 percent, to $1.4 billion, is proposed for support to *space science, applications, and technology* in 1980. A 16-percent increase is proposed for each of the two major subprograms of space sciences and space and terrestrial applications. The latter subprogram includes a new research initiative in agricultural research to apply remote sensing to crop production estimation, especially in foreign areas, and to early warnings of natural disasters.

• **Health** research and development is expected to increase less than 2 percent in 1980, to $3.4 billion, compared with 14-percent increase in 1979. Virtually all R&D programs within this function are sponsored by the Department of Health, Education, and Welfare (HEW). R&D budget authority as a percent of total budget authority for health is 6.0 percent for 1980, a small decline from the 1979 level.

The National Institutes of Health (NIH) account for 86 percent of the health R&D total in 1980. No significant changes in funding are proposed for any of the institutes or any research programs within the institutes, with one exception. An increase is shown for the population research program of the National Institute of Child Health and Human Development, which is expected to grow 10 percent in 1980. Some areas of special attention within the NIH budget request for 1980 are not apparent, however, since they involve more than one institute. As part of a broad prevention research initiative, for example, $11 million has been redirected from various institute

funds for increased efforts in research on smoking. Other important cross-institute areas include nutrition, diabetes, and recombinant DNA research.

• **Energy** R&D is expected to decline approximately 2 percent, to $3.4 billion, in 1980. This reflects an administration policy of concentrating on longer-term R&D projects that have high levels of risk combined with high payoff potential and where there is little incentive for private investment. With increases in prices and other incentives for the private sector, such as are provided through the recently enacted National Energy Act, private firms can be expected to finance research and development where technical risks are relatively low and development times relatively short. Energy R&D budget authority as a percent of total energy budget authority is an estimated 76 percent in 1980, excluding from the total $15 billion in anticipated new borrowing authority for the Tennessee Valley Authority power program.

Despite an overall decrease of 15 percent for Department of Energy (DOE) *nuclear fission* programs, this area is still the largest within the energy function, comprising almost one-fourth of the R&D total. The decrease is primarily caused by a decision not to proceed with the Clinch River breeder reactor program.

The proposed decline of 9 percent in DOE *fossil fuel* R&D programs primarily reflects a cut in oil and gas recovery demonstration programs.

An increase of 11 percent is scheduled for overall *solar* R&D efforts, including an increase of 16 percent for longer term solar technology. Other substantial DOE increases are scheduled for energy-related *basic research, environmental R&D, magnetic fusion,* and *biomass* programs. R&D funds of the Nuclear Regulatory Commission (NRC) are scheduled to increase 14 percent in 1980, to $183 million.

• **General science and basic research** R&D support totals $1.2 billion in 1980, up 11 percent from the 1979 estimate. This function includes those Federal R&D programs that are viewed as supporting and extending the Nation's scientific base in a broad sense rather than supporting the missions of agencies with specific responsibilities like national defense, health, or space exploration. The programs that fall within this area are sponsored by two agencies: the National Science Foundation (NSF) and DOE. All of the NSF R&D programs and three DOE programs not subsumed under energy are included. Within the general science and basic research function 84 percent of the total budget authority in 1980 consists of R&D programs, most of them basic research.

In 1980 NSF R&D programs reflect an increase of 11 percent, to $910 million, with most of the increase shown in research project support across all major fields of science. DOE research programs are expected to increase 9 percent, to $337 million, mostly the result of a $20 million increase for high-energy physics.

• **Natural resources and environment** R&D budget authority is expected to increase by 6 percent to $1.1 billion in 1980. This represents 8 percent of total budget authority for this function.

An increase of 16 percent, to $333 million, is proposed for R&D programs of the Environmental Protection Agency (EPA). These are all related to pollution control and abatement and include a major initiative in preventive health concerned with improving the EPA health data base. R&D programs of the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce are expected to increase 17 percent, to $208 million, in 1980. A decline of 14 percent, to $107 million, in R&D efforts of the Bureau of Mines, Department of the Interior, reflects elimination of the mined land demonstration program.

• **Transportation** R&D is expected to increase 5 percent, to $862 million, in 1980. The only significant change is the increase of 9 percent, to $490 million, in the NASA aeronautical research and technology program, which makes up more than one-half of all transportation R&D activities. The 1980 budget for this NASA program provides for further strengthening of the research and technology base; aircraft energy efforts aimed at providing improved technology leading to a major reduction in fuel requirements for transport aircraft; and research into reducing noise and pollution and improving safety and terminal area operations.

R&D budget authority for transportation as a percent of total budget authority for this function is an estimated 5 percent in 1980.

• **Agriculture** R&D budget authority is scheduled for an overall net increase of less than 1 percent, to a total of approximately $560 million, in 1980, reflecting a policy of the Department of Agriculture of emphasizing and funding only high priority research projects not likely to be funded otherwise.

R&D budget authority for agriculture as a portion of total budget authority for the function is expected to increase from 7 percent in 1979 to 12 percent in 1980. This increase is the result of a large decline in the farm income stabilization program, which does not have an R&D component.

• **Education, training, employment, and social services** R&D budget authority in 1980 is expect to show an increase of only 1 percent, to $350 million. No significant changes are proposed for any of the components or programs. R&D budget authority as a percent of total budget authority for this function is an estimated 1 percent in 1980.

• The seven remaining functions—**veterans benefits, international affairs, community and regional development, commerce and housing credit, administration of justice, income security,** and **general government**—represent areas in which R&D activities play a relatively

small part. In no function does the R&D component make up more than 1 percent of the total. In another perspective, none of these areas amounts to as much as one-half of 1 percent of all Federal R&D budget authority in 1980, and collectively they make up less than 2 percent of the Federal R&D total.

Basic Research Programs Distributed by Function

Although most R&D activities within the general science and basic research function are basic in character, they account for only one-fourth of all Federal basic research. Thus, the major portion of Federal basic research funds is allocated to other budget functions that reflect other national needs or missions—such as defense, health, or space research and technology. Basic research funding for health alone accounts for one-third of the total budget authority for Federal basic research in 1980. Most of this work is sponsored by NIH. The space function accounts for one-eighth of the basic research total, with most of this effort representing NASA space science applications and technology. National defense represents one-tenth of the basic total with the continuing DOD effort to build the technology base mission area. Each of the other three leading functions in terms of basic research funding—natural resources and environment, agriculture, and energy—supports approximately 5 percent of the total effort (table 2).

Table 2. Budget authority for basic research by function

(Dollars in millions)

Function	1978 Actual	1979 Estimate	1980 Estimate
Total	$3,665	$4,214	$4,587
Health	1,246	1,533	1,548
General science and basic research	962	1,034	1,148
National Science Foundation	678	741	828
Department of Energy	284	293	320
Space research and technology	412	455	551
National defense	320	380	441
Natural resources and environment	207	231	238
Agriculture	197	220	237
Energy	157	178	229
Transportation	70	78	81
Education, training, employment and social services	57	63	67
Commerce and housing credit	9	12	14
Administration of justice	10	11	13
Veterans benefits	9	10	10
Community and regional development	8	10	9
Income security	1	1	1
International affairs	(1)	(1)	—
General government	—	—	—

[1] Less than $500,000.

Source: National Science Foundation

Copies of *Federal R&D Funding by Budget Function: Fiscal Years 1978-80* are obtainable upon request from the Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550.